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LAKE ONTELAUNEE, BERKS COUNTY, PENNSYLVANIA

Pacific Northwest Environmental Research Laboratory

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June 1975

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NATIONAL EUTROPHICATION SURVEY

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16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

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ON
LAKE ONTELAUNEE
BERKS COUNTY
PENNSYLVANIA
EPA REGION III
WORKING PAPER No. 422

WITH THE COOPERATION OF THE
PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL RESOURCES
AND THE
PENNSYLVANIA NATIONAL GUARD

JUNE, 1975

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FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nation-wide threat of accelerated eutrophication to fresh water lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's fresh water lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the Pennsylvania Department of Environmental Resources for professional involvement and to the Pennsylvania National Guard for conducting the tributary sampling phase of the Survey.

Walter A. Lyon, Director of the Bureau of Water Quality Management, Richard M. Boardman, Chief of the Division of Water Quality, and James T. Ulanoski, Aquatic Biologist of the Division of Water Quality, provided invaluable lake documentation and counsel during the Survey, reviewed the preliminary reports, and provided critiques most useful in the preparation of this Working Paper series.

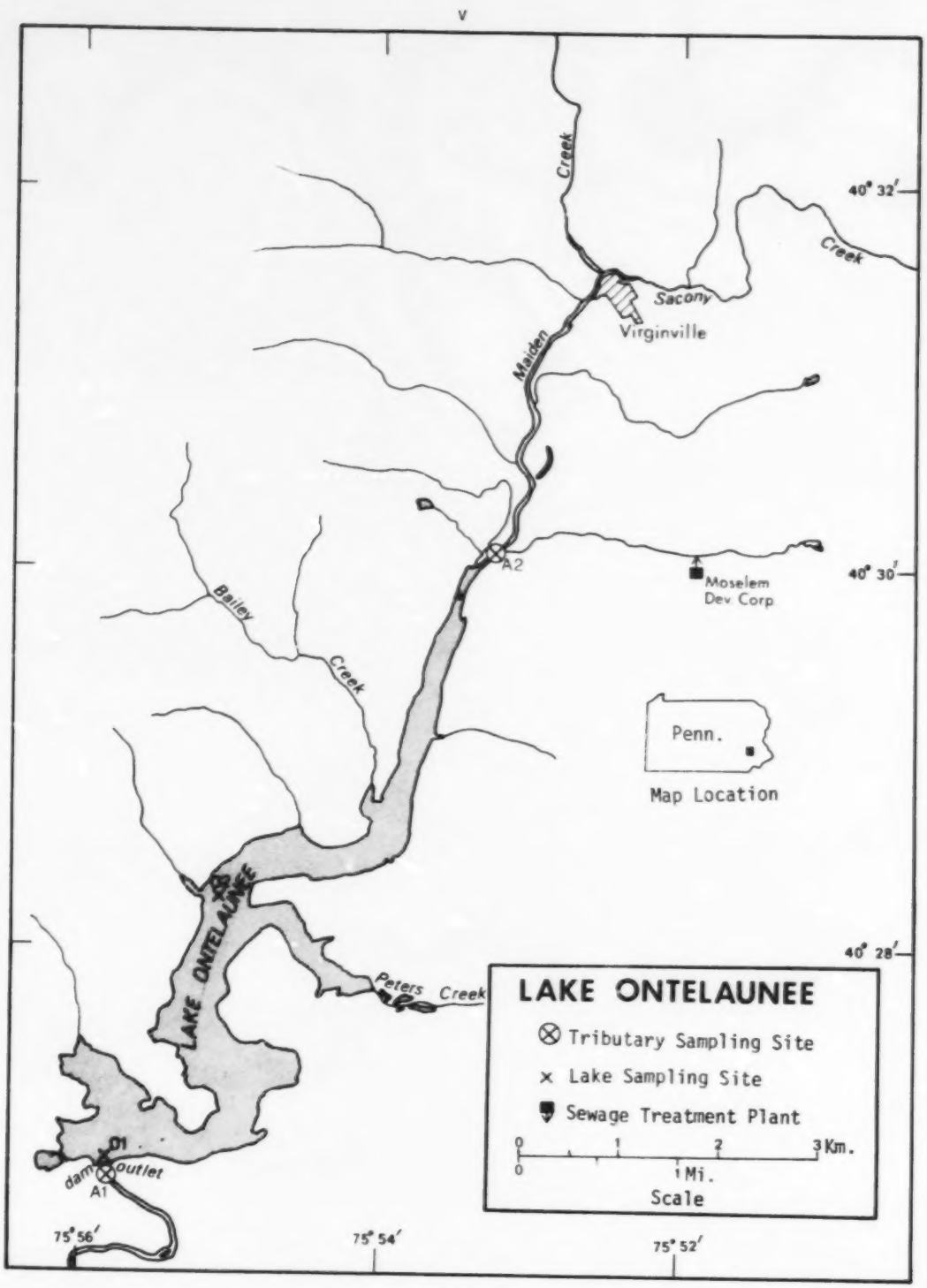
Major General Harry J. Mier, Jr., the Adjutant General of Pennsylvania, and Project Officer Major Ronald E. Wickard, who directed the volunteer efforts of the Pennsylvania National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

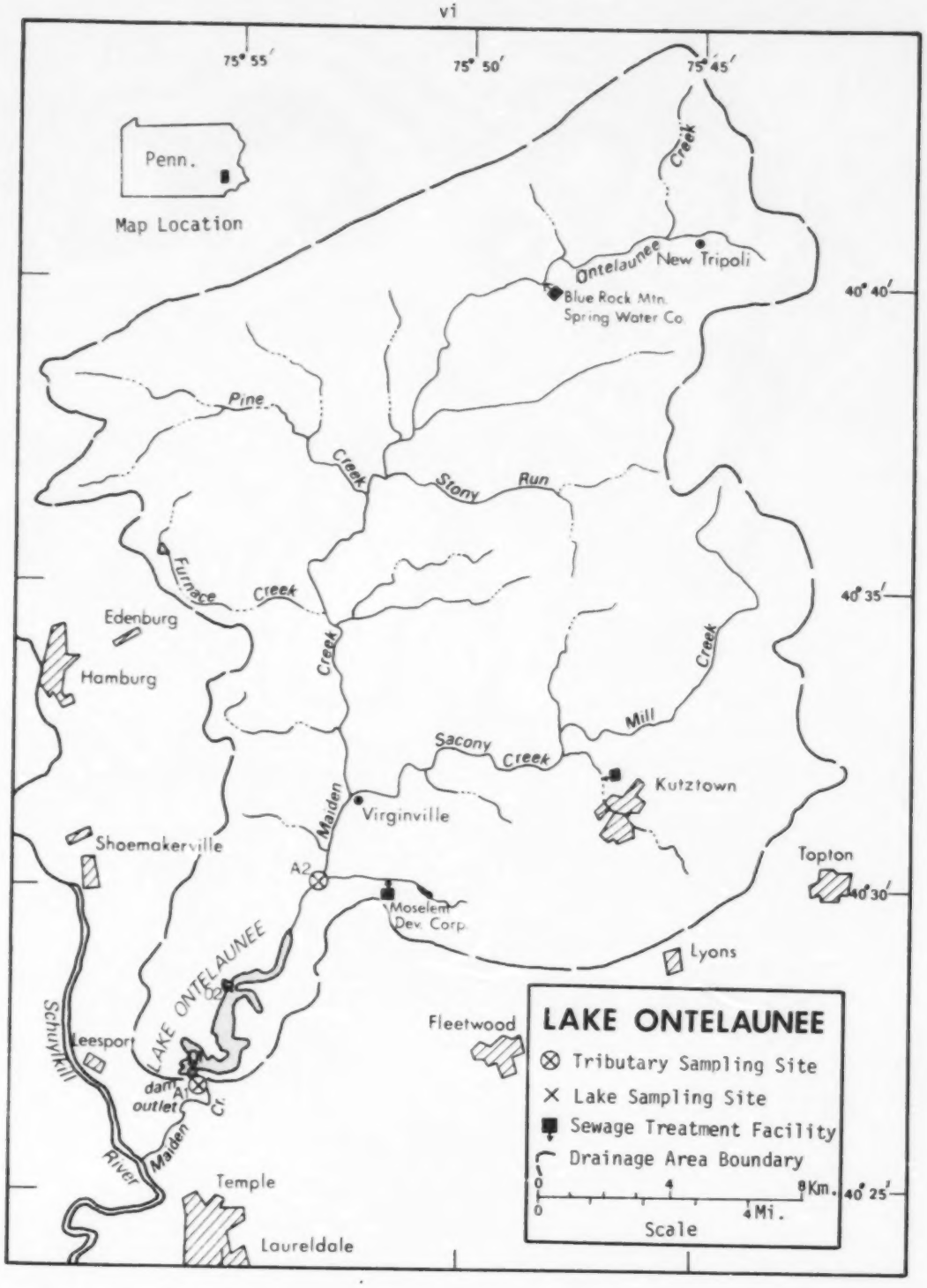
NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF PENNSYLVANIA

LAKE NAME	COUNTY
Allegheny Reservoir	McKean, Warren, PA; Cattarugus, NY
Beaver Run Reservoir	Westmoreland
Beltzville	Carbon
Blanchard Reservoir	Centre
Canadohta	Crawford
Conneaut	Crawford
Conewago (Pinchot)	York
Greenlane	Montgomery
Harveys	Luzerne
Indian	Somerset
Naomi	Monroe
Ontelaunee	Berks
Pocono	Monroe
Pymatuning Reservoir	Crawford, PA; Ashtabula, OH
Shenango River Reservoir	Mercer
Stillwater	Monroe
Wallenpaupack	Pike, Wayne


Creek
40° 32′
Creek
Sacony
Virginville
Maiden
A2
Moselem
Dev Corp
40° 30′
Bailey
Creek
Penn.
Map Location
LAKE ONTELAUNEE
40° 28′
Peters Creek
LAKE ONTELAUNEE
Tributary Sampling Site
Lake Sampling Site
Sewage Treatment Plant
0 1 2 3 Km.
0 1 Mi.
Scale
D1
dam
outlet
A1
75° 56′
75° 54′
75° 52′


75° 55′
75° 50′
75° 45′
Penn.
Map Location
Creek
Ontelaunee
New Tripoli
Blue Rock Mtn.
Spring Water Co.
40° 40′
Pine
Creek
Stony
Run
Furnace
Creek
40° 35′
Edenburg
Hamburg
Creek
Creek
Mill
Sacony
Creek
Kutztown
Maiden
Virginville
Shoemakerville
A2
Topton
40° 30′
Moselem
Dev. Corp.
Lyons
LAKE ONTELAUNEE
Schuylkill
Fleetwood
Leesport
dam
outlet
A1
Cr.
Maiden
River
Temple
Laureldale
LAKE ONTELAUNEE
Tributary Sampling Site
Lake Sampling Site
Sewage Treatment Facility
Drainage Area Boundary
0
4
8 Km.
40° 25′
0
4 Mi.
Scale

LAKE ONTELAUNEE*

STORET NO. 4225

I. CONCLUSIONS

A. Trophic Condition:

Survey data indicate that Lake Ontelaunee is eutrophic. It ranked fifteenth in overall trophic quality when the 17 Pennsylvania lakes sampled in 1973 were compared using a combination of six lake parameters**. Only four of the lakes had higher median total phosphorus levels, two had higher median dissolved phosphorus, none had higher median inorganic nitrogen, all lakes had greater mean Secchi disc transparency, and nine had less mean chlorophyll a. Depression of dissolved oxygen with depth occurred at both sampling stations in July and October, 1973.

Survey limnologists noted that the water was turbid on all sampling occasions. Algal blooms were observed on the second and third visits at station two and in the Maiden Creek section of the lake during the third visit. Floating and emergent aquatic weeds were observed near station one on the third visit.

B. Rate-Limiting Nutrient:

The algal assay results show that Lake Ontelaunee was phosphorus limited at the time the assay sample was collected

* Table of metric conversions--Appendix A.
** See Appendix B.

(04/13/73). The lake data indicate phosphorus limitation at all sampling times.

C. Nutrient Controllability:

1. Point sources--During the sampling year, Lake Ontelaunee received a total phosphorus load at a rate nearly three times that proposed by Vollenweider (Vollenweider and Dillon, 1974) as a eutrophic rate (see page 14). However, Vollenweider's model probably does not apply to water bodies with short hydraulic retention times, and the mean hydraulic retention time of Lake Ontelaunee is only 14 days.

It is calculated that the waste treatment plants included in the Survey contributed nearly 75% of the total phosphorus load to the lake during the sampling year. Removal of 90% of the phosphorus at these point sources would reduce the loading rate to 1.56 $g/m^2/yr$. This rate is less than Vollenweider's eutrophic rate but more than his oligotrophic rate (i.e., a mesotrophic rate); and, regardless of applicability of the model, the reduced rate should result in a significant improvement in the trophic condition of Lake Ontelaunee once a new phosphorus equilibrium becomes established.

2. Non-point sources--It is estimated that non-point sources contributed about 25% of the total phosphorus load to Lake Ontelaunee during the sampling year. Maiden Creek, the only major

tributary, had a relatively low phosphorus export rate of 9 $kg/km^2/yr$ (see page 13). The probable effectiveness of point-source phosphorus control is substantiated by this rather low non-point export rate.

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS

A. Lake Morphometry†:

1. Surface area: 4.38 kilometers^2.
2. Mean depth: 3.4 meters.
3. Maximum depth: 9.4 meters.
4. Volume: 14.892 x 10^6 m^3.
5. Mean hydraulic retention time: 14 days (based on outlet flow).

B. Tributary and Outlet:
(See Appendix C for flow data)

1. Tributaries -

Name	Drainage area (km^2)*	Mean flow (m^3/sec)*
Maiden Creek	404.0	8.2
Minor tributaries & immediate drainage -	151.0	3.6
Totals	555.0	11.8

2. Outlet -

Maiden Creek	559.4**	12.0

C. Precipitation***:

1. Year of sampling: 121.5 centimeters.
2. Mean annual: 111.7 centimeters.

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† Ulanoski, 1975.
* For limits of accuracy, see Working Paper No. 175, "...Survey Methods, 1973-1976".
** Includes area of lake
*** See Working Paper No. 175.

III. LAKE WATER QUALITY SUMMARY

Lake Ontelaunee was sampled three times during the open-water season of 1973 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from two stations on the lake and from a number of depths at each station (see map, page v). During each visit, a single depth-integrated (4.6 m or near bottom to surface) sample was composited from the stations for phytoplankton identification and enumeration; and during the first visit, a single 18.9-liter depth-integrated sample was composited for algal assays. Also each time, a depth-integrated sample was collected from each of the stations for chlorophyll a analysis. The maximum depths sampled were 7.9 meters at station 1 and 3.0 meters at station 2.

The lake sampling results are presented in full in Appendix D and are summarized in the following table.

A. SUMMARY OF PHYSICAL AND CHEMICAL CHARACTERISTICS FOR ONTELAUNEE LAKE
STORET CODE 4225

PARAMETER	1ST SAMPLING (6/13/73) 7 SITES RANGE	MEAN	MEDIAN	2ND SAMPLING (7/24/73) 2 SITES RANGE	MEAN	MEDIAN	3RD SAMPLING (10/ 3/73) 2 SITES RANGE	MEAN	MEDIAN
TEMP (C)	9.0 - 9.4	9.1	9.1	19.1 - 26.6	23.8	23.9	18.9 - 20.9	19.7	19.7
DISS OXY (MG/L)	10.6 - 11.4	11.0	11.0	0.2 - 11.9	5.9	6.1	9.2 - 12.9	8.9	9.3
CNDCTVY (MCHOMO)	190. - 200.	195.	197.	170. - 235.	204.	201.	244. - 260.	252.	252.
PH (STAND UNITS)	7.1 - 8.0	7.7	7.6	7.0 - 9.1	8.0	8.0	7.4 - 9.2	8.3	8.3
TOT ALK (MG/L)	32. - 40.	34.	34.	59. - 85.	69.	70.	71. - 90.	78.	78.
TOT P (MG/L)	0.015 - 0.034	0.025	0.024	0.033 - 0.057	0.044	0.045	0.030 - 0.073	0.048	0.043
ORTHO P (MG/L)	0.007 - 0.018	0.013	0.013	0.007 - 0.020	0.012	0.009	0.008 - 0.019	0.011	0.011
NO2+NO3 (MG/L)	2.400 - 3.200	2.843	3.050	1.400 - 2.400	2.000	2.000	1.350 - 2.040	1.677	1.655
AMMONIA (MG/L)	0.010 - 0.080	0.050	0.060	0.040 - 0.750	0.267	0.150	0.050 - 0.270	0.100	0.060
KJEL N (MG/L)	0.200 - 0.400	0.317	0.300	0.600 - 1.100	0.757	0.700	0.500 - 1.100	0.750	0.700
INORG N (MG/L)	2.600 - 3.260	3.033	3.085	2.040 - 2.590	2.267	2.150	1.410 - 2.150	1.777	1.710
TOTAL N (MG/L)	2.700 - 3.500	3.360	3.400	2.500 - 3.000	2.757	2.700	2.240 - 2.540	2.427	2.435
CHLRPYL A (UG/L)	2.4 - 2.4	2.4	2.4	9.6 - 12.4	11.2	11.2	16.2 - 26.3	21.2	21.2
SECCHI (METERS)	0.3 - 0.5	0.4	0.4	0.8 - 1.0	0.9	0.9	1.0 - 1.1	1.0	1.0

B. Biological characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Algal units per ml
04/13/73	1. Stephanodiscus	680
	2. Asterionella	107
	3. Cryptomonas	67
	4. Melosira	67
	5. Flagellates	67
	Other genera	89
	Total	1,077
07/24/73	1. Scenedesmus	181
	2. Coelastrum	140
	3. Gloeocystis	131
	4. Oocystis	74
	5. Merismopedia	49
	Other genera	114
	Total	689
10/03/73	1. Melosira	4,698
	2. Fragilaria	3,085
	3. Pediastrum	111
	4. Chlorophyta filament	91
	5. Oocystis	81
	Other genera	94
	Total	8,160

2. Chlorophyll a -

Sampling Date	Station Number	Chlorophyll a (µg/l)
04/13/73	01	2.8
	02	2.9
07/24/73	01	12.9
	02	9.6
10/03/73	01	26.3
	02	16.2

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.024	2.976	4.7
0.050 P	0.074	2.976	25.9
0.050 P + 1.0 N	0.074	3.976	24.5
1.0 N	0.024	3.976	4.6

2. Discussion -

The control yield of the assay alga, Selenastrum capricornutum, indicates that the potential primary productivity of Lake Ontelaunee was high at the time the assay sample was collected. Only four of the 17 Pennsylvania lakes studied had a greater assay control yield.

The N/P ratio of the control sample, the response to the orthophosphorus spike, and the lack of response when only nitrogen was added, show that the control sample was phosphorus limited.

The lake data indicate phosphorus limitation at all sampling times; i.e., the mean N/P ratios were 162/1 or greater, and phosphorus limitation would be expected.

IV. NUTRIENT LOADINGS
(See Appendix E for data)

For the determination of nutrient loadings, the Pennsylvania National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page vi), except for the high runoff month of April when two samples were collected. Sampling was begun in May, 1973, and was completed in April, 1974.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the Pennsylvania District Office of the U.S. Geological Survey for the tributary sites nearest the lake.

In this report, nutrient loads for sampled tributaries were determined by using a modification of a U.S. Geological Survey computer program for calculating stream loadings*. Nutrient loads shown are those measured minus point-source loads, if any.

Nutrient loads for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were estimated using the adjusted nutrient loads at station A-2, in kg/km^2/year, and multiplying by the ZZ area in km^2.

The operators of the Kutztown and Blue Rock Mountain Spring Water Company wastewater treatment plants provided monthly effluent samples and corresponding flow data. The Moselem Development Corporation did

* See Working Paper No. 175.

not participate in the Survey, and nutrient loads were estimated at 1.134 kg P and 3.401 kg N/capita/year. The community of Virginville was assumed to be served by septic tanks, and nutrient loads attributed to that source are included in the septic tank loads.

A. Waste Sources:

1. Known muncipal* -

Name	Pop. Served	Treatment	Mean Flow (m^3/d)	Receiving Water
Kutztown	10,000	trickling filter	7,344.0	Sacony Creek
Moselem Development Corp.	150	act. sludge	56.8**	Moselem Creek
Blue Rock Mtn. Spring Water Co.	30	sand filter	3.6	Ontelaunee Creek

2. Known industrial - None

* Treatment plant questionnaires.
** Estimated at 0.3785 m^3/capita/day.

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	kg P/yr	% of total
a. Tributaries (non-point load) -		
Maiden Creek	3,775	18.0
b. Minor tributaries & immediate drainage (non-point load) -	1,360	6.5
c. Known municipal STP's -		
Kutztown	15,540	74.2
Moselem Development Corp.	170	0.8
Blue Rock Mtn. Spring Water	5	<0.1
d. Septic tanks* -	30	0.1
e. Known industrial - None	-	-
f. Direct precipitation** -	75	0.4
Total	20,955	100.0

2. Outputs -

Lake outlet - Maiden Creek 18,255

3. Net annual P accumulation - 2,700 kg.

* Estimate based on 96 shoreline dwellings along Maiden Creek and 14 dwellings along Sacony Creek; see Working Paper No. 175.
** See Working Paper No. 175.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	kg N/yr	% of total
a. Tributaries (non-point load) -		
Maiden Creek	738,550	68.8
b. Minor tributaries & immediate drainage (non-point load) -	276,030	25.7
c. Known municipal STP's -		
Kutztown	52,120	4.9
Moselem Development Corp.	510	<0.1
Blue Rock Mtn. Spring Water	15	<0.1
d. Septic tanks* -	1,170	0.1
e. Known industrial - None	-	-
f. Direct precipitation** -	4,730	0.4
Total	1,073,125	100.0

2. Outputs -

Lake outlet - Maiden Creek 1,254,715

3. Net annual N loss - 181,590 kg.

D. Mean Annual Non-point Nutrient Export by Subdrainage Area:

Tributary	kg $P/km^2/yr$	kg $N/km^2/yr$
Maiden Creek	9	1,828

* Estimate based on 96 shoreline dwellings along Maiden Creek and 14 dwellings along Sacony Creek; see Working Paper No. 175.
** See Working Paper No. 175.

E. Yearly Loading Rates:

In the following table, the existing phosphorus loading rates are compared to those proposed by Vollenweider (Vollenweider and Dillon, 1974). Essentially, his "dangerous" rate is the rate at which the receiving water would become eutrophic or remain eutrophic; his "permissible" rate is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic rate would be considered one between "dangerous" and "permissible".

Note that Vollenweider's model may not be applicable to water bodies with short hydraulic retention times.

	Total Phosphorus		Total Nitrogen	
	Total	Accumulated	Total	Accumulated
grams/m^2/yr	4.78	0.62	245.0	loss*

Vollenweider loading rates for phosphorus ($g/m^2/yr$) based on mean depth and mean hydraulic retention time of Lake Ontelaunee:

"Dangerous" (eutrophic rate)	1.76
"Permissible" (oligotrophic rate)	0.88

* There was an apparent loss of nitrogen during the sampling year. This may have been due to nitrogen fixation in the lake, solubilization of previously sedimented nitrogen, recharge with nitrogen-rich ground water, unknown and unsampled point sources discharging directly to the lake, or underestimation of the nitrogen loads from the upper Maiden Creek drainage area. Whatever the cause, a similar nitrogen loss has occurred at Shagawa Lake, Minnesota, which has been intensively studied by EPA's National Eutrophication and Lake Restoration Branch.

V. LITERATURE REVIEWED

Anonymous, 1971. Inventory of municipal waste facilities. EPA Publ. No. OWP-1, vol. 3, Washington, D.C.

Ulanoski, James, 1975. Personal communication (lake morphometry). PA Dept. of Env. Resources, Harrisburg.

Vollenweider, R. A., and P. J. Dillon, 1974. The application of the phosphorus loading concept to eutrophication research. Natl. Res. Council of Canada Publ. No. 13690, Canada Centre for Inland Waters, Burlington, Ontario.

VI APPENDICES

APPENDIX A

CONVERSION FACTORS

CONVERSION FACTORS

Hectares x 2.471 = acres

Kilometers x 0.6214 = miles

Meters x 3.281 = feet

Cubic meters x 8.107×10^{-4} = acre/feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 = cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

APPENDIX B

LAKE RANKINGS

LAKES RANKED BY INDEX NOS.

RANK	LAKE CODE	LAKE NAME	INDEX NO
1	4224	LAKE NAOMI	445
2	4220	BELTZVILLE DAM	423
3	4222	HARVEY'S LAKE	413
4	4228	STILLWATER LAKE	401
5	4227	POCONO LAKE	389
6	4223	INDIAN LAKE	388
7	3641	ALLEGHENY RESERVOIR	385
8	4229	LAKE WALLENPAUPACK	371
9	4221	CANADOHTA LAKE	369
10	4219	BEAVER RUN RESERVOIR	360
11	4204	CONNEAUT LAKE	307
12	4226	PINCHOT LAKE	256
13	4213	PYMATUNING RESERVOIR	206
14	4216	SHENANGO RIVER RESERVOIR	157
15	4225	ONTELAUNEE DAM	101
16	4201	BLANCHARD RESERVOIR	85
17	4207	GREENLANE DAM	53

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS P	INDEX NO
3641	ALLEGHENY RESERVOIR	56 (9)	38 (6)	63 (10)	100 (16)	69 (11)	59 (8)	385
4201	BLANCHARD RESERVOIR	13 (2)	13 (2)	25 (4)	31 (5)	3 (0)	0 (0)	85
4204	CONNEAUT LAKE	44 (7)	63 (10)	69 (11)	56 (9)	34 (5)	41 (6)	307
4207	GREENLANE DAM	6 (1)	6 (1)	19 (3)	13 (2)	3 (0)	6 (1)	53
4213	PYMATUNING RESERVOIR	0 (0)	72 (11)	6 (1)	0 (0)	100 (16)	28 (4)	206
4216	SHENANGO RIVER RESERVOIR	19 (3)	44 (7)	13 (2)	6 (1)	47 (7)	28 (4)	157
4219	BEAVER RUN RESERVOIR	94 (15)	19 (3)	88 (14)	81 (13)	19 (2)	59 (8)	360
4220	BELTZVILLE DAM	88 (14)	25 (4)	94 (15)	94 (15)	34 (5)	88 (13)	423
4221	CANADOHTA LAKE	50 (8)	97 (15)	56 (9)	19 (3)	59 (9)	86 (13)	369
4222	HARVEY'S LAKE	63 (10)	81 (13)	100 (16)	63 (10)	47 (7)	59 (8)	413
4223	INDIAN LAKE	100 (16)	31 (5)	75 (12)	75 (12)	19 (2)	88 (13)	388
4224	LAKE NAOMI	81 (13)	88 (14)	44 (7)	69 (11)	88 (14)	75 (12)	445
4225	ONTELAUNEE DAM	25 (4)	0 (0)	0 (0)	44 (7)	19 (2)	13 (2)	101
4226	PINCHOT LAKE	31 (5)	56 (9)	31 (5)	38 (6)	81 (13)	19 (3)	256
4227	POCONO LAKE	38 (6)	97 (15)	50 (8)	88 (14)	75 (12)	41 (6)	389
4228	STILLWATER LAKE	72 (11)	72 (11)	38 (6)	25 (4)	94 (15)	100 (16)	401
4229	LAKE WALLENPAUPACK	72 (11)	50 (8)	81 (13)	50 (8)	59 (9)	59 (8)	371

LAKE DATA TO BE USED IN RANKINGS

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS P
3641	ALLEGHENY RESERVOIR	0.016	0.380	414.250	3.700	13.800	0.006
4201	BLANCHARD RESERVOIR	0.064	1.300	453.143	15.187	14.900	0.046
4204	CONNEAUT LAKE	0.023	0.185	402.000	7.567	14.600	0.007
4207	GREENLANE DAM	0.066	1.475	460.222	24.011	14.900	0.020
4213	PYMATUNING RESERVOIR	0.070	0.180	467.750	56.333	7.700	0.008
4216	SHENANGO RIVER RESERVOIR	0.058	0.340	463.555	26.800	14.500	0.008
4219	BEAVER RUN RESERVOIR	0.009	0.835	384.833	5.183	14.800	0.006
4220	BELTZVILLE DAM	0.010	0.815	362.444	4.856	14.600	0.005
4221	CANADOHTA LAKE	0.020	0.130	436.000	19.167	14.100	0.005
4222	HARVEY'S LAKE	0.015	0.160	338.000	5.967	14.500	0.006
4223	INDIAN LAKE	0.008	0.520	400.222	5.211	14.800	0.005
4224	LAKE NAOMI	0.014	0.135	443.333	5.533	8.000	0.005
4225	ONTELAUNEE DAM	0.040	2.150	470.667	11.783	14.800	0.011
4226	PINCHOT LAKE	0.027	0.245	453.000	13.950	11.500	0.008
4227	POCONO LAKE	0.024	0.130	438.800	4.980	13.200	0.007
4228	STILLWATER LAKE	0.015	0.180	449.000	18.233	7.900	0.004
4229	LAKE WALLENPAUPACK	0.015	0.250	394.583	9.617	14.100	0.006

APPENDIX C

TRIBUTARY FLOW DATA

Reproduced from best available copy.

LAKE CODE ... LAKE UNTITLED

TOTAL DRAINAGE AREA OF LAKE(S) ... SQ MI

TRIBUTARY	SUB-DRAINAGE AREA(SQ MI)	JAN	FEB	MAR	APR	MAY	ACCUMULATED FLOW(CFS) JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = ... SQ MI
SUM OF SUB-DRAINAGE AREAS = ... SQ MI

TOTAL FLOW AT = ...
TOTAL FLOW OUT = ...

MEAN MONTHLY FLOWS AND DAILY FLOWS(CFS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...

APPENDIX D

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 75/01/27

422501
40 26 45.0 075 56 05.0
UNTELAUNEE DAM
42011 PENNSYLVANIA

11EPALES
3

2111202
0020 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/04/13	16 15	0000	9.8		10	198	8.00	40	0.060	0.400	3.000	0.016
	16 15	0005	9.8	10.6		190	7.60	40	0.060	0.300	2.400	0.018
	16 15	0015	9.8	11.0		200	7.30	39	0.060	0.400	3.000	0.017
73/07/24	11 35	0000	26.6		30	196	9.10	59	0.120	0.700	2.000	0.007
	11 35	0005	25.8	11.9		195	9.00	60	0.120	0.700	2.000	0.009
	11 35	0015	20.7	9.2		210	7.30	85	0.450	0.700	2.000	0.017
	11 35	0026	18.1	8.5		170	7.00	70	0.750	1.100	1.400	0.020
73/10/03	00 00	0000	20.6		42	244	9.20	71	0.060	1.100	1.350	0.008
	00 00	0005	19.7	9.6		246	8.30	72	0.060	0.900	1.480	0.011
	00 00	0015	18.6	4.2		253	7.40	78	0.270	0.600	1.880	0.011

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/04/13	16 15	0000	0.034	2.8
	16 15	0005	0.020	
	16 15	0015	0.039	
73/07/24	11 35	0000	0.033	12.9
	11 35	0005	0.046	
	11 35	0015	0.040	
	11 35	0026	0.057	
73/10/03	00 00	0000	0.035	26.3
	00 00	0005	0.043	
	00 00	0015	0.030	

STORET RETRIEVAL DATE 75/01/27

422502
40 28 16.0 075 55 07.0
UNTELAUNEE LAKE
42011 PENNSYLVANIA

11EPALES
3

2111202
0014 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/04/13	16 45	0000	8.4		18	190	7.80	38	0.050	0.300	3.200	0.017
	16 45	0004	8.4	11.4		200	7.60	37	0.060	0.300	3.200	0.016
	16 45	0010	8.4	11.0		195	7.70	39	0.010K	0.200	3.100	0.007
73/07/24	12 05	0000	26.3		38	207	9.10	63	0.090	0.800	2.000	0.007
	12 05	0005	25.9	10.3		214	8.80	70	0.150	0.700	2.200	0.009
	12 05	0009	23.9	6.7		235	8.30	79	0.190	0.600	2.400	0.013
73/10/03	00 00	0000	20.8		38	250	9.10	90	0.060	0.800	1.620	0.008
	00 00	0005	19.7	12.4		257	8.80	77	0.050	0.600	1.690	0.011
	00 00	0010	18.7	9.0		260	8.40	80	0.100	0.500	2.040	0.019

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/04/13	16 45	0000	0.024	2.9
	16 45	0004	0.034	
	16 45	0010	0.015	
73/07/24	12 05	0000	0.040	9.6
	12 05	0005	0.046	
	12 05	0009	0.048	
73/10/03	00 00	0000	0.044	15.2
	00 00	0005	0.073	
	00 00	0010	0.064	

K VALUE KNOWN TO BE
LESS THAN INDICATED

APPENDIX E

TRIBUTARY and WASTEWATER TREATMENT PLANT DATA

STORET RETRIEVAL DATE 75/02/03

4225A1
40 26 48.0 075 56 00.0
MAIDEN CR
42089 7.5 TEMPLE
U/LAKE GNTELAUNEE
20 FT BELO BASE OF DAM
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/05/14	13 40		1.880	1.700	0.065	0.005K	0.047
73/06/16	12 30		2.000	0.885	0.037	0.006	0.040
73/07/07	12 10		2.200	3.900	0.099	0.012	0.060
73/08/04	13 05		1.300	0.690	0.026	0.005	0.023
73/09/08	13 15		0.350	2.900	1.000	0.023	
73/10/06	13 45		1.460	1.050	0.025	0.012	
73/11/03	13 14		1.400	0.750	0.084	0.020	0.080
73/12/01	13 00		2.100	1.500	0.168	0.012	0.060
74/01/05	13 25		1.840	0.200	0.044	0.016	0.045
74/02/02	13 10		3.700	0.400	0.027	0.020	0.045
74/03/02	13 20		3.080	0.600	0.020	0.015	0.075
74/04/06	13 02		2.600	0.600	0.020	0.025	0.050
74/04/13	12 15		3.080	0.200	0.025	0.016	0.045

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/02/03

4225A2
40 30 05.0 075 53 14.0
MAIDEN CR
42 7.5 HAMBURG
1/LAKE ONTELAUNEE
HWY 662 BRDG AT MOSELEM
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/05/14	14 10		2.020	0.100K	0.027	0.025	0.045
73/06/16	12 35		2.300	1.200	0.073	0.039	0.075
73/07/07	12 41		2.800	0.710	0.033	0.032	0.070
73/08/04	13 30			0.260			0.095
73/09/08	13 32		1.880	0.480	0.040	0.115	0.145
73/10/06	12 55		1.860	1.150	0.050	0.061	0.115
73/11/03	13 25		2.700	0.300	0.032	0.040	0.065
73/12/01	13 12		2.100	0.200	0.022	0.054	0.085
74/01/05	13 50		1.800	0.200	0.020	0.020	0.040
74/02/02	13 41		3.700	0.500	0.045	0.020	0.030
74/03/02	13 35		3.200	0.500	0.030	0.025	0.070
74/04/06	12 41		2.500	0.900	0.045	0.025	0.105
74/04/13	12 30		2.760	0.200	0.020	0.019	0.050

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/02/03

4225RA TF4225RA P010000
40 31 40.0 075 47 00.0
BOROUGH OF KUTZMAN
42089 7.5 KUTZTOWN
T/LAKE ONTELAUNEE
SACOOMY CREEK/MAIDEN CREEK
LIEPALES 2141204
0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
73/06/28	07 00								
CP(I)-			8.500	3.700	0.070	5.200	6.000	0.700	0.778
73/06/28	15 00								
73/07/27	07 30								
CP(I)-			9.500	14.700	3.780	5.100	6.100	0.730	0.827
73/07/27	14 30								
73/08/28	08 00								
CP(I)-			5.700	3.700	0.630	5.900	7.100	0.620	0.690
73/08/28	15 00								
73/09/27	08 00								
CP(I)-			4.800	13.200	3.360	6.000	6.000	0.850	0.800
73/09/27	15 00								
73/10/26	08 00								
CP(I)-			4.900	15.500	2.310	6.300	7.000	8.500	8.000
73/10/26	15 00								
73/11/27	08 00								
CP(I)-			4.100	15.000	3.000	5.600	7.000	0.800	0.810
73/11/27	15 00								
73/12/27	08 00								
CP(I)-			6.700	3.000	0.041	1.300	2.050	2.000	1.300
73/12/27	15 00								
74/01/28	08 00								
CP(I)-			7.200	10.000	0.480	3.300	7.200	1.300	1.170
74/01/28	15 00								
74/02/28	07 00								
CP(I)-			6.900	8.600	0.290	3.750	4.700	1.000	1.200
74/02/28	14 00								
74/03/28	07 00								
CP(I)-			5.700	4.700	0.050K	3.150	3.900	1.200	1.160
74/03/28	14 00								
74/04/26	07 00								
CP(I)-			5.700	7.500	0.420	4.200	5.300	0.900	1.100
74/04/26	14 00								
74/05/28	08 00								
CP(I)-			14.300	8.300	0.050K	4.000	5.200	0.620	0.846

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/02/03

4225XA TF4225XA P010000
40 31 40.0 075 47 00.0
BOROUGH OF KUTZMAN
42089 7.5 KUTZTOWN
T/LAKE ONTELAUNEE
SACOUWY CREEK/MAIDEN CREEK
11EPALES 2141204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
74/06/28	12 30		10.050	15.000	3.000	4.400	5.400	6.900	6.600

STORET RETRIEVAL DATE 75/02/03

42252A SF42252A P0003007
40 34 00.0 075 46 00.0
BLUE ROCK MOUNTAIN SPRING WATER
42 7.5 NEW TRIPOLI
T/LAKE ONTELAUNEE
ONTELAUNEE CREEK/MAIDEN CREEK
11EPALES 2141204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
73/08/08	14 50		5.900		0.500	1.200	2.600	0.001	0.001
73/10/10	11 00		13.400	0.500K	0.010K	4.750	5.300	0.001	
74/01/23	08 00		1.680	5.200	0.890	0.440	0.470	0.001	0.001
74/04/11			6.920	5.000	1.700	0.820	1.000	0.001	0.001
74/06/12	12 00		18.420	2.500	0.182	4.825	5.250	0.001	
74/07/12	14 00		13.400	6.000	0.320	3.600	4.000	0.001	0.001
74/09/13	13 15		5.900	0.710	0.075	4.000	4.550	0.001	0.001
74/09/20	14 00		15.000	1.950	1.900	4.300	4.600	0.001	0.001
74/10/17	15 00		5.975	1.000K	0.490	3.900	3.900	0.001	
74/11/14	08 00		5.800	1.000K	0.110		1.350	0.001	0.001
74/11/21	09 00							0.001	0.001

K VALUE KNOWN TO BE
LESS THAN INDICATED